

which, in a great manufacturing country like this, ought certainly not to be the least important of all. H. T. WOOD.  
Society of Arts, Aug. 22

### The Diurnal Inequalities of the Barometer

LIKE the author of the interesting paper on the daily inequalities of the barometer in *NATURE*, vol. xiv. p. 314, I am one of those who are waiting for the appearance of the second part of Mr. Buchan's essay on this subject. Perhaps the coming meeting of the British Association at Glasgow may elicit from Mr. Buchan the result of his laborious investigations. I own that I am not only anxious to ascertain if his views coincide with my own,<sup>1</sup> but desire very much to have at my command the thorough discussion of the data for the eighty-six stations which Mr. Buchan has collected.

So far as a correct explanation of the inequalities is concerned, I believe it must be one that can dispense with the lateral movements of the air proposed by Mr. Blanford, and be applicable alike during the calm days of the "doldrums," and during periods of great wind disturbance. It must explain, too, seasonal differences in their amount, and we may infer that what will explain a seasonal difference will probably explain also a geographical difference of the same kind.

In the barometric co-efficients for Calcutta, supplied by Mr. Blanford, the semicircular one  $U'$  is nearly twice as great in April as it is in July, and the quadrantal co-efficient  $U''$  is one third greater in March than it is in June. The hour angle  $u'$  does not vary so much as it does in this country, and the angle  $u''$  shows its usual very remarkable constancy. In England the co-efficient  $U''$  seems to have a greater proportionate range than at Calcutta. This will be seen by the following monthly means obtained from Mr. Main's discussion of the observations made at the Radcliffe Observatory, Oxford.

*Mean Daily Quadrantal Oscillation of the Barometer for each month at Oxford for the sixteen years, 1858-1873 inclusive. In units of .0001 of an inch :-*

March ... ..	120	September ... ..	120
April ... ..	118	October ... ..	109
May ... ..	101	November ... ..	90
June ... ..	98	December ... ..	92
July ... ..	94	January ... ..	74
August ... ..	108	February ... ..	111

The epochs of maximum effect seem here to correspond with the greatest thermometric range rather than with epochs of greatest heat. I think it will also be found in this country that this inequality is as large, if not larger, during continuous strong westerly winds as during quiet anticyclonic periods.

Like Mr. Blanford I was led to this subject by a study of the daily inequalities of the wind. My having arrived at a very different result must be my excuse for pointing out what seem to me to be points of difference between the conditions which he theoretically investigates and those which exist in nature. Mr. Blanford shows that "when a given quantity of heat is employed in heating dry air at the temperature of 80°, it raises its pressure more than seven times as much as when it simply charges it with vapour without altering the temperature." Mr. Blanford very properly premises that this occurs "while the volume remains constant." It is also implied that the volumes of air are of equal tension throughout. But where do these conditions obtain in volumes of the atmosphere? Such a volume, for example, as rests on a square yard, a square mile, or a hundred square miles of the earth's surface. This volume may easily be supposed to remain perfectly constant, while the tension of its parts may vary enormously. No ordinary addition of heat to the base of this volume will increase its total weight or sensibly add to the tension of the air at the surface of the earth. The added heat will alter the relative tension of portions of the lower third or half of the volume, and will be expended in raising to a small extent the centre of gravity of the whole. When this is done, that is, when the dynamical effect of the added heat is completed, the barometer at the base of the volume of the atmosphere will in reality read a little lower, instead of showing the greater tension required by Mr. Blanford's investigation. And this will be the case whether the added heat has expanded dry air only, or has evaporated particles of water already in the atmosphere. In either case I apprehend that during the upward movement of the warm air or of the lighter

vapour the barometer would read lower than at the moment when the movement was completed.

An elevation of the centre of gravity of the atmosphere equal to two-thirds of a mile, barometer at 30 inches, would reduce the weight of the atmosphere by about the one-hundredth of an inch. The centre of gravity of the air over an elevated station like Leh in Ladakh would have to be raised several miles to produce so large a change of pressure as .1034 of an inch, the difference between the maximum night and day value of co-efficient  $U'$  as given by Mr. Blanford—so many miles as, in my opinion, to compel one to look for some other cause for the production of part of the observed effect, and that cause, I believe, will be found in the dynamical one already indicated.

W. W. RUNDELL

### Visual Phenomena

ALTHOUGH most people are familiar with the appearances which surround, or perhaps I should say form, the image on the retina of a luminous point, their origin, I believe, is not so generally known, and it is not uncommon to hear them ascribed to reflection from the eyelids and eyelashes, which in reality plays no part in their production. There are three distinct phenomena which go to make up the appearance of a luminous point, but they are not generally all visible at once. I will describe them for convenience of reference as phenomena A, B, and C.

(A). The luminous point appears to be surrounded by short rays, seldom more than a degree in length, generally much less, the length depending on the brightness of the point and the size of the pupil at the time.

These rays are what make a bright point look star-shaped (Fig. 1).

(B). Upwards and downwards from the point proceed two bundles of rays, each often 20° or more in length, and inclined to one another at an obtuse angle (Fig. 2).

Fig. 1.



Fig. 2



(C). Coloured rays such as are shown in Fig. 3, which are only seen when the eyelids are nearly closed.

These perhaps it is hardly necessary to say are produced by diffraction through the eyelashes.

(B) is due to refraction through the small band of tears, which is retained by capillarity in the angle between the inner edge of the eyelid and the eye (shown at  $t$  and  $t'$ , Fig. 4), and which acts as a curved prism, although its effect is only visible when the lids are advanced far enough over the cornea to allow light which passes close to them to enter the pupil.

The following simple experiments show that this explanation is the right one.

1. While looking at a bright point so as to see (B), draw down the lower eyelid, the upper bundle of rays will then disappear. This shows that the upper rays are caused by the lower eyelid, and also that as the image on the retina is inverted, the light must take some such course as shown by the dotted lines in Fig. 5. Now in no conceivable way could reflection from the

<sup>1</sup> On the Diurnal Inequalities of the Barometer and Thermometer. *Quarterly Journal of the Meteorological Society*, Oct., 1874

lower eyelid produce this effect, whilst it is evident that a prism of the shape taken by the liquid in the angle must produce it.

2. If the bright point be examined in front of a looking-glass, so that the eye, its reflection, and the point are in a straight line, it will be found that (B) does not begin to be visible till the eyelid is just beginning to eclipse the pupil, showing that it is the light which grazes the lid that produces the effect. I have accurately reproduced the phenomenon by fitting a lens of short focus

Fig. 3

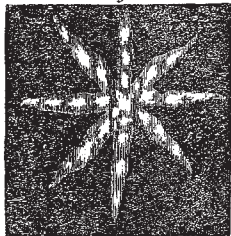
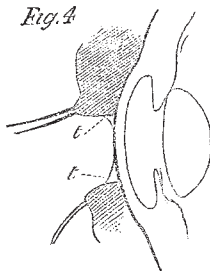


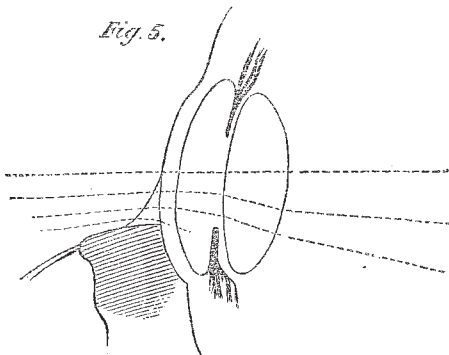
Fig. 4



into a pair of artificial eyelids, moistening the angle between the lens and lid, and photographing a bright point with the combination thus made. The diffraction effect (c) was also reproduced in this manner when the lids were brought close together.

The phenomenon (A) may be studied in the following manner:—Throw into the eye, by means of a lens or mirror, a pencil of light so widely divergent as to form a luminous patch on the retina, whose border is the shadow of the iris. If the pencil

Fig. 5.

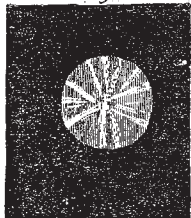


proceed from a point, this border is well defined and dust on the cornea and any small irregularities in the distribution of moisture on its surface are rendered clearly visible by the diffraction rings and bands which surround their shadows. But what is most

striking is the star-shaped figure (Fig. 6) which occupies the whole lighted area.

If now the divergence of the pencil be gradually diminished, which it may be by withdrawing the eye further from the focus of the lens, this area diminishes in size and increases in brightness towards the centre, leaving, however, the rays of the star still bright, and protruding into the region which has now become unilluminated; and when the luminous point is far enough off to enable the eye to focus rays proceeding from it, the phenomenon (A) is seen to

Fig. 6.



be the limiting form of this star-shaped figure. The rays in the figure correspond with the stellate structure of the crystalline lens, to which, therefore, I conclude that (A) is due.

ARNULPH MALLOCK

#### Antedated Books

As Editor of the Zoological Society's *Transactions*, I must maintain, in direct opposition to "Another F.Z.S.," that we set a good, and not a bad, example in dating our books. The parts of the *Transactions* not being issued at regular dates, I have

adopted the plan of placing the date at which the paper is going finally through the press at the foot of each sheet, for the very purpose of giving its correct date as nearly as possible. The part is always on sale within a month at least, I think I may say, after this date; so that this date and that of publication are to all practical purposes identical.

P. L. SCLATER,  
Secretary to the Zoological  
Society of London

Aug. 22

MR. R. BOWDLER SHARPE makes a singular defence to my comments on his "evil practice" of issuing, in August, 1876, a work dated on the cover May, 1875. He says that if I had looked into the interior I should have found "abundant evidence" to convince me that the date on the cover was a false one. Seeing that when I wrote my former letter I had only just received the number from the publishers, I had no need to search for further evidence of such being the fact. Mr. Sharpe must be aware that the covers of works issued in parts are often bound up for the express purpose of preserving a record of the date of issue. How will this plan operate in the case of the second edition of the "Birds of Africa?"

"Another F.Z.S." states that in his copy the date "May, 1875" has a line drawn through it. This is not the case with my copy, nor is it so in others which I have examined.

F.Z.S.

#### Kerguelen's Land

If Mr. R. Bowdler Sharpe considers that, having published a description of the new Teal from Kerguelen's Land, he has done all that is necessary in relation to the collection of birds made by Mr. Eaton in that distant island, he will, I fear, find but few persons to agree with him. Most of his brother naturalists will side with me that our American friends have shown much greater energy in getting out a complete account of the ornithology of this interesting island at an early date than Mr. Sharpe in issuing a short notice of the single undescribed species.

THE REVIEWER OF "THE BIRDS OF  
KERGUELEN'S LAND"

#### A Large Meteor

I HAVE just seen a large meteor. It fell vertically in a line passing half-way between the pole-star and the nearer pointer, disappearing about  $15^\circ$  above the horizon. Where it came from I did not see. At disappearance it seemed a very elongated pear-shape, and changed colour from red to violet (commencing at the edges). Its horizontal diameter was about  $20'$ . Time 8.10 P.M. about; my point of view, 4 miles due south of the dome of St. Paul's.

I may add, that on the night of Thursday, 10th, between half-past 11 and 1, while on a long drive in the neighbourhood of York, and looking up at the clear sky only as circumstances permitted, I counted twenty, and saw more, the moon shining brightly at the time.

RICHARD VERDON

London, Aug. 21

[Mr. Paul Robin, writing from Sheerness, states that on Monday evening, at 8.10 P.M., he saw a meteor brighter than Jupiter, with a white luminous train of about  $5^\circ$ . Its course crossed a line from the pole-star, joining the pointers.]

#### THE "CHALLENGER" EXPEDITION

WE have already published (vol. xiv. p. 197) the weighty testimony borne to the value of the *Challenger* Expedition by the leaders of science in Vienna. The following no less valuable address to Sir C. Wyville Thomson has been sent us for publication:—

To Prof. Sir C. Wyville Thomson, F.R.S., Director of the Civilian Staff of the "Challenger" Expedition, Edinburgh.

R. Museo di Fisica e Storia Naturale di Firenze,  
Florence, July 7, 1876

SIR,—The professors of the Natural Science Section of the Royal Institute of Florence have followed with the most intense interest the researches on the deep-sea fauna initiated by you during the *Lightning* and *Porcupine* expeditions, and so splendidly followed up during the voyage round the world of the *Challenger*. With anxious expectation we have followed the